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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
ZERVIGON, RUDY	

ART UNIT	PAPER NUMBER
1763	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/722,485	NARUSHIMA, MASAKI
	Examiner	Art Unit
	Rudy Zervigon	1763

PL8

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 November 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-13 and 17-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-13 and 17-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 22 recites the limitation "said process gas". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 18, 31, 36, 37, 38, 39, and 43 are rejected under 35 U.S.C. 102(b) as being anticipated by Logan et al (USPat. 5,155,652). Logan et al teaches :

18. A ceramic heater system comprising an upper heater base (52, Figure 1) integrally formed of a ceramic material (3, lines 34-45); and a lower heater base (60) formed of a ceramic material (column 3, lines 45-60), the upper and lower heater bases forming a one-body heater base ("conducting electrical energy"; column 3, lines 46-53), with a lower surface of the upper heater base being in tight contact with the lower heater base once the components of the electrostatic chuck assembly (40) are assembled,

the heater base (40, Figure 1 once assembled) including:

a mounting surface (42; column 2, lines 54-60) which is formed as an upper surface of the heater base (40, Figure 1 once assembled) and on which an object ("semiconductor wafer under process (not shown)") is mounted,

a heater (54, 56 – column 3, lines 40-43), buried (56) in the upper heater base, for heating the object (column 3, lines 32-45),

a fluid passage (78; column 3, lines 55-65) provided in the lower surface (70) of the heater base (40, Figure 1 once assembled) and formed as a groove through which a fluid is supplied toward the mounting surface,

wherein the heater base is cooled by causing a fluid (column 3, lines 59-65; column 4, lines 1-13) whose temperature is lower than a temperature of the heater base (column 4, lines 1-13) to be supplied through the fluid passage.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1, 10, 12, 44, 45, 46, 47, 48, and 49 rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652). Logan is discussed above. Logan further teaches:

1. A ceramic (column 4, lines 41-48) heater system (Figure 1) comprising: a ceramic heater base (<u>40</u>, Figure 1; column 3, lines 32-53) formed of a ceramic material (column 4, lines 41-48). The heater base including a object ("product wafer (not shown)"; column 4, line 1) mounting surface formed on an upper surface (42, Figure 1) thereof; a heater winding (54, "heating pattern" Figure 1; column 3, lines 30-50), buried (column 4, lines 28-49) in the heater base for heating an

object; and a fluid passage (78, Figure 1; column 3, lines 59-65) provided in the heater base (after bonding – column 4, lines 28-49) below the heater, whereby the heater base is cooled by causing a fluid (column 3, lines 59-65; column 4, lines 1-13) whose temperature is lower than a temperature of the heater base (column 4, lines 1-13) to be supplied through the fluid passage.

10. The ceramic heater system (40, Figure 1) according to claim 1, wherein the heater (54, Figure 1; column 3, lines 30-50) is formed of graphite (column 3, line 38) shaped in such a pattern as to evenly generate heat in the heater base.

12. The ceramic heater system (40, Figure 1) according to claim 1, further comprising: an electrode (46, Figure 1) buried in the heater base <u>and located between the heater (54) and the and the mounting surface (42; column 2, lines 54-57)</u>; and a DC power (column 2, line 65 – column 3, line 5) supply for applying a DC voltage to the electrode; whereby applying the DC voltage to the electrode causes the object mounted on the mounting surface to be electrostatic ally chucked.

Logan further teaches that the fluid passage has a fluid inlet and a fluid outlet (not shown, Figure 1) formed in a lower section (70) of the heater base (column 3, lines 62-68) – "circulating a cooling fluid" requires an entrance and exit connected to a pump.

Logan does not teach that the heater base is integrally (totally) formed of a ceramic material. In particular the only components that are not made of boron nitride (ceramic material) are heater base components 45 and 72 (Figure 1). Logan also does not teach the ceramic heater system wherein the heater has a high-melting-point metal patterned in such a coil form as to evenly generate heat in the heater base and two zones. Logan also does not teach a glassy boron nitride layer coated over Logan's graphite heater (54, column 3, lines 34-36) embedded in pyrolytic

boron nitride (52, column 3, lines 32-35). Logan does not teach that the upper heater base and lower heater base are coupled together by a ceramic adhesive, however Logan does teach that the heat sink base (70) and the support (60) are coupled together by a ceramic adhesive (column 4, lines 28-45).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Logan to manufacture his heat sink base (72) and pattern layer (44) of boron nitride or other ceramics (column 3, lines 13-15) and for Logan to replace his pyrolitic graphite material with a high-melting point metal material including fabricating Logan's substrate layer 45 of boron nitride with a coating of glassy boron nitride thereover and bonding additional components of his ceramic heater with his ceramic adhesive.

Motivation for Logan to manufacture his heat sink base (72) and pattern layer (44) of boron nitride or other ceramics (column 3, lines 13-15) and for Logan to replace his pyrolitic graphite material with a high-melting point metal material including fabricating Logan's substrate layer 45 of boron nitride with a coating of glassy boron nitride thereover is to provide for alternate and equivalent material of construction and bondings.

5. Claims 2, 4-6, 9, 11, 17, 19, 23, 24, 28, 29, 30, 32, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652) in view of Manabu Edamura (JP407337630A)[1]. Logan is discussed above. Logan further teaches - 5. The ceramic heater wherein the fluid which flows in the fluid passage is at least one gas selected from Ar, He, Ne and N_2 gases or a mixed gas thereof (column 4, lines 1-13). Logan also teaches - 11. The

[1] Machine Translation from http://www1.ipdl.jpo.go.jp/PA1/cgi-bin/PA1DETAIL

ceramic heater system according to claim 9, wherein the heater has glassy boron nitride (column 3, lines 32-40) coated on an outer surface of graphite of which the heater is formed (column 3, line 38). 5. - The ceramic heater wherein the fluid which flows in the fluid passage is at least one gas selected from Ar, He, Ne and N_2 gases or a mixed gas thereof (column 4, lines 5-10).

Logan et al does not teach:

2. The ceramic heater system according to claim 1, wherein the fluid passage has a plurality of concentric circular passage portions and a plurality of penetration passage portions connecting the circular portions passage, and any adjacent two of the penetration passage portions are not aligned in a radial direction

4. The ceramic heater system, wherein the fluid passage has a fluid inlet <u>formed in a central portion of</u> a lower <u>surface</u> of the heater base and fluid outlets <u>formed in outer circumference portions of the lower surface</u> of the heater base.

6. Argon gas as a the heat transfer gas

9. The ceramic heater system according to claim 1, wherein the heater has a high-melting-point metal patterned in such a coil form as to evenly generate heat in the heater base and two zones

11. a glassy boron nitride layer coated over Logan's graphite heater (54, column 3, lines 34-36) embedded in pyrolytic boron nitride (52, column 3, lines 32-35)

17. The ceramic heater system according to claim 1, wherein the fluid passage has a fluid inlet formed in a central portion of a lower surface of the heater base and a plurality of fluid outlets formed through circumferential side walls of the heater base.

19. a chamber whose interior can be kept in a vacuum state by and exhaust system and a heater base that is integrally formed of a ceramic material because Logan only teaches ceramic materials (boron nitride) for the heater base components of 42, 50, and 60 as discussed above. Logan teaches base 70 made from KOVAR and does not teach a specific material for component 44/45.

Manabu Edamura teaches a similarly cooled electrostatic chuck arrangement (Figures 1, 2, 7; abstract) including an electrostatic chuck (3, abstract): a fluid passage (7, abstract; Figure 7) provided in the chuck base whereby the base is cooled by letting a fluid (helium and argon; abstract) to flow in the fluid passage further including:

2. An electrostatic chuck wherein the fluid passage has a plurality of concentric circular passage portions (7, abstract; Figure 7) and a plurality of penetration passage portions (3, abstract; Figure 7) connecting the circular portions passage – see Figure 7 and compare with Applicant's Figure 2.

4. fluid passages (7, Figure 1, 2, 7) with a fluid inlet (6, Figure 1,2) <u>formed in a central portion of</u> a lower <u>surface</u> of the heater base and fluid outlets (7, Figure 1,2) <u>formed in outer circumference portions of the lower surface</u> of the base.

5,6. The ceramic heater wherein the fluid which flows in the fluid passage is at least one gas selected from Ar and He (abstract).

17. fluid passages with a fluid inlet (6, Figure 2) formed in a central portion (6, Figure 2) of a lower surface of the heater base and a plurality of fluid outlets formed through circumferential side walls of the heater base – Figure 3 shows the pressure distribution across the back surface of

the wafer. The pressure is shown at 10Torr at the center ([Example]) and drops to 5mTorr (the chamber pressure, [Example]). As a result of the pressure gradient from the center to the edge of the back surface, a flow of coolant is established.

19. a chamber (1) whose interior can be kept in a vacuum state (5mTorr [Example]) by and exhaust system (2) and a heater base (3)

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Logan to replace his heat sink base with Manabu Edamura's heat sink base made of ceramic material, and for Logan to replace his pyrolitic graphite material with a high-melting point metal material including fabricating Logan's substrate layer 45 of boron nitride with a coating of glassy boron nitride thereover.

Motivation for Logan to replace his heat sink base with Manabu Edamura's heat sink base made of ceramic material is to provide for uniform heating or cooling of the semiconductor wafer as taught by Manabu Edamura (abstract).

Motivation for Logan to replace his pyrolitic graphite material with a high-melting point metal material including fabricating Logan's substrate layer 45 of boron nitride with a coating of glassy boron nitride thereover is to provide alternate and equivalent material of construction.

6. Claim 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over unpatentable over Logan et al (USPat. 5,155,652) and Manabu Edamura (JP407337630A) as applied to claim 19 above, and further in view of Ameen et al (USPat. 6,143,128). Both Logan and Manabu Edamura are discussed above. Logan further teaches a lower electrode (46; column 3, lines 1-5) in the heater base (40, Figure 1; column 3, lines 32-53) and located between an upper surface

(42) of the heater base and the heater (54). However, Logan and Manabu Edamura do not teach a showerhead fed by a process-gas supply mechanism. Manabu Edamura and Logan each do not teach an RF powered showerhead that is electrically isolated. Ameen teaches a similar plasma processing apparatus (Figure 1; column 5, line 66 – column 6, line 30) including a showerhead (61) fed by a process-gas supply mechanism (11). Ameen teaches an RF powered showerhead that is electrically isolated (column 7, lines 9-26, 33-44). Ameen further teaches an etching gas (21, 22, 29; Figure 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add Ameen's electrically isolated RF powered showerhead and process-gas supply mechanism to Manabu Edamura's processing apparatus.

Motivation to add Ameen's showerhead and process-gas supply mechanism to Manabu Edamura's processing apparatus is to evenly distribute the process gases over the substrate.

7. Claims 7 and 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652) and Manabu Edamura (JP407337630A) and further in view of Arasawa et al (USPat. 5,547,539). Logan and Manabu Edamura do not teach:

7. The ceramic heater system according to claim 1, wherein a ratio of H_2 flow rate to Ar flow rate is 20% or more.

Arasawa et al teaches:

7. The ceramic heater system wherein a ratio of H_2 flow rate to Ar flow rate is controllable (27b, 28b, Figure 1; column 5, lines 13-21)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the independent gas control of Arasawa et al as part of the Manabu Edamura apparatus.

Motivation for use the independent gas control of Arasawa et al as part of the Manabu Edamura apparatus is increase the efficiency of cooling an object as taught by Arasawa et al (column 2, line 25).

8. Claims 8, 13, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652) and Manabu Edamura (JP407337630A) in view of Fuji et al (USPat. 6,135,052). Logan et al does not teach means for temperature adjustment of the fluid coolant from a heat exchanger when controlling wafer temperature. Fuji et al teaches wafer temperature control with means for temperature adjustment of the fluid coolant by a heat exchanger (item 4, Figure 1; claim 1; column 2, lines 47-52) thereby imparting temperature control of a wafer. Fuji et al also teaches a showerhead with associated process gas supply (column 3, lines 60-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Manabu Edamura's coolant fluid sources with Fuji's coolant fluid sources including wafer temperature control means for temperature adjustment of the fluid coolant.

Motivation to replace Manabu Edamura's coolant fluid sources with Fuji's coolant fluid sources including wafer temperature control means for temperature adjustment of the fluid coolant is to provide for wafer temperature control during processing as taught by Fuji (column 2, lines 39-46).

9. Claim 25, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652). Logan is discussed above. However, Logan does not teach the

temperature of the coolant fluid supplied to the heater base (40, Figure 1; column 3, lines 32-53) as being between 10 and 800°C.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Logan to provide the coolant fluid provided to the heater to have a temperature as being between 10 and 800°C.

Motivation for Logan to provide the coolant fluid provided to the heater to have a temperature as being between 10 and 800°C is to optimize the heat removed from the wafer as taught by Logan (column 4, lines 5-13). Further, it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele , 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc . v. Biocraft Laboratories Inc. , 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied , 493 U.S. 975 (1989); In re Kulling , 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

10. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652) in view of Steger et al (USPat. 5,788,799). Logan is discussed above. Logan further teaches an oxide-based metallic material ("alumina"; column 3, line 15 – Al_2O_3). However, Logan does not teach aluminum nitride (AlN) as an alternate ceramic material. Steger teaches ceramic liner materials (claim 6) for plasma facing chamber components (column 7,lines 41-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Logan to replace his boron nitride component materials with aluminum nitride as taught by Steger.

Motivation for Logan to replace his boron nitride component materials with aluminum nitride as taught by Steger is to provide alternate and equivalent materials of construction as taught by Steger (claims 2, 6, and 10).

11. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652) in view of Whitaker et al (USPat. 4,622,687). Logan is discussed above. However, Logan does not teach his fluid passage having an increased surface area thereby providing an improved heat transfer (heating/cooling efficiency). Whitaker teaches a heat transfer fluid conduit (43, Figure 2, 2A) with an increased surface area (surface roughness; column 18, line 68 – column 19, line 2) thereby providing an improved heat transfer (heating/cooling efficiency).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Logan to roughen the internal surface area of the fluid conduit as taught by Whitaker.

Motivation for Logan to roughen the internal surface area of the fluid conduit is to provide an improved heat transfer as taught by Whitaker (column 18, line 68 – column 19, line 2).

12. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Logan et al (USPat. 5,155,652) in view of Randlett et al (USPat.5,415,225). Logan is discussed above. Logan does not teach heat radiating/absorbing fins in the fluid passages. Randlett teaches a heat exchange tube (60, Figure 9) including a first internal surface (14) with heat exchange fins (column 7, lines 4-34).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Logan to add heat exchange fins as taught by Randlett in the coolant flow conduit of the ceramic heater system.

Motivation for Logan to add heat exchange fins as taught by Randlett in the coolant flow conduit of the ceramic heater system is to enhance the heat exchange efficiency as taught by Randlett.

Response to Arguments

13. Applicant's arguments with respect to claims 1, 2, 4-13, and 17-22 have been considered but are moot in view of the new grounds of rejection.

14. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "the only components which are bonded to each other are the ceramics support 60 and the heat sink base 70") are not recited in the rejected claim. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

15. Applicant's position that Logan does not teach an embedded heater is addressed above in the body of the rejections.

16. Applicant's position that Logan does not teach an upper heater base and a lower heater base is addressed in the body of the rejections above.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry

of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

JEFFRIE R. LUND
PRIMARY EXAMINER